Response to Office Action
Serial No. 10/766,976

LISTING OF CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently amended) A method of detecting an imminent collision comprising the steps of:

producing from imagery a depth map of a scene proximate a platform;

detecting a potential threat in the depth map by tessellating the depth map into a number of patches and selecting a plurality of patches for processing;

estimating the size of the detected potential threat;

estimating the position of the detected potential threat;

estimating the velocity of the detected potential threat;

performing a trajectory analysis of the detected potential threat using the estimated position and the estimated velocity; and

performing a collision prediction based on the trajectory analysis.

2. (Original) The method of claim 1, further including determining if a collision is imminent based on the collision prediction and on the estimated size of the potential threat.

3. (Original) The method of claim 1, further including filtering the estimated position and filtering the estimated velocity before performing trajectory analysis.

4. (Original) The method of claim 2 wherein the filtering includes Kalman filtering.

5. (Original) The method of claim 1 wherein estimating the velocity of the detected potential threat includes the step of identifying 2-dimensional feature correspondences from imagery produced in different time frames.

6. (Currently amended) The method of claim 5 wherein estimating the velocity of the detected potential threat further includes the step of obtaining 3D correspondences from the 2-dimensional feature correspondences and from the tessellated depth map.

7. (Original) The method of claim 6 wherein estimating the velocity of the detected potential threat further includes the step of estimating velocity using Random Sample Consensus.

8. (Currently amended) The method of claim 1 wherein ~~detecting a potential threat in the depth map includes the steps of~~ processing a plurality of patches comprises:

~~tessellating the depth map into a number of patches;~~

~~selecting a plurality of patches for subsequent processing;~~

fitting a plane to each patch of said plurality of the patches;

obtaining a normal vector to each plane; and

classifying each patch of said plurality of patches into a class, where one class represents the patches that are likely represent a potential threat, another class represents the patches that possibly representing a potential threat, and another class represents the patches that are unlikely to represent a potential threat, wherein classifying is based on the obtained normal vector for each patch.

9. (Original) The method of claim 8 further including the step of grouping patches that are likely to represent a potential threat together.

10. (Original) The method of claim 9 further including the step of creating a bounding box that represents a potential threat, wherein the bounding box is created in accord with the grouping of patches.

11. (Currently amended) The method of claim 8 wherein detecting a potential threat in the tessellated depth map includes the steps of moving each patch after local

tessellation to find the region of maximum stereo density near the original patch location, of discarding a patch if the region of maximum stereo density does not meet a predetermined criteriaon, and adding the patch to the plurality of the patches if the patch density meets the predetermined criteriaon.

12. (Original) The method of claim 8 wherein obtaining a normal vector includes the steps of calculating the third Eigen-vector of a matrix of patch values using a singular valued decomposition of the matrix, and then estimating the normal vector as the third Eigen-vector.

13. (Currently amended) A collision detection system, comprising:

a stereo camera pair for producing imagery of a scene;

a stereo image preprocessor for preprocessing said imagery;

a depth map generator for producing a depth map from said preprocessed imagery; and

a collision detector for tessellating the depth map into a number of patches and determining from said tessellated depth map and from said imagery if a collision is imminent;

wherein said collision detector detects a potential threat in said tessellated depth map;

wherein said collision detector estimates size, position, and velocity of said detected potential threat;

wherein said collision detector performs a trajectory analysis of said detected potential threat using said estimated position and said estimated velocity;

wherein said collision detector predicts a collision based on said trajectory analysis; and

wherein said collision detector determines if a collision is imminent based on said collision prediction and on said estimated size.

14. (Original) The system of claim 13, wherein said collision detector includes a filter

for filtering image noise and outliers from said estimated position and from said estimated velocity before performing trajectory analysis.

15. (Currently amended) The system of claim 13 wherein said collision detector estimates said by identifying 2-dimensional feature correspondences from imagery produced in different time frames and then obtains 3D correspondences of said 2-dimensional feature correspondences using said tessellated depth map.

16. (Original) The system of claim 13, further including a host vehicle, wherein said stereo camera pair is mounted in fixed locations relative to said host vehicle.

17. (Currently amended) The system of claim 13 wherein said collision detector detects a potential threat in the tessellated depth map by:

~~tessellating said depth map into a number of patches;~~

fitting a plane to a plurality of said patches;

obtaining normal vectors to said plurality of patches;

classifying each of said plurality of patches, based on said normal vector for that patch, as likely to represent a potential threat, as possibly representing a potential threat, or as being unlikely to represent a potential threat; and.

grouping patches that are likely to represent a potential threat together; and forming a bounding box around said potential threat based on said patch groupings.

18. (Currently amended) The system of claim 17 wherein said collision detector searches each patch after tessellation to find a densest part of said patch, discards said patch if said patch density does not meet a predetermined criteriaon, and adds said patch to said plurality of patches if said patch density meets said predetermined criteriaon.

19. (Original) The system of claim 17 wherein obtaining normal vectors includes the steps of calculating for each patch a third Eigen-vector of a matrix of patch values using

a singular valued decomposition of said matrix, and then estimating said normal vector as said third Eigen-vector.

20. (Currently amended) A computer readable medium having stored thereon a plurality of instructions, the plurality of instruction including instructions which, when executed by a processor causes the processor to perform the steps comprising:

producing from imagery a depth map of a scene proximate a platform;

detecting a potential threat in the depth map by tessellating the depth map into a number of patches and selecting a plurality of patches for processing;

estimating the size of the detected potential threat;

estimating the position of the detected potential threat;

estimating the velocity of the detected potential threat;

performing a trajectory analysis of the detected potential threat using the estimated position and the estimated velocity; and

performing a collision prediction based on the trajectory analysis.

21. (Original) The computer readable medium of claim 20 that further causes the processor to filter the estimated position and the estimated velocity before performing trajectory analysis.

22. (Original) The computer readable medium of claim 20 that further causes the processor to determine the velocity by identifying 2-dimensional feature correspondences from imagery produced in different time frames.

23. (Currently amended) The computer readable medium of claim 22 that further causes the processor to determine velocity by obtaining 3D correspondences from the 2-dimensional feature correspondences and from the tessellated depth map.

24. (Currently amended) The computer readable medium of claim 20 that further causes the processor to detect the potential threat by the steps of: